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FEDERAL COMMUNICATIONS COMMISSION
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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the matter of)
)
Amendments to Parts 1, 2, and 21)
of the Commission's Rules govern-)
ing use of the Frequencies in the)
2.1 and 2.5 GHz band.)

PR Docket No. 92-80
RM 7909

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Comments Pertaining to
NOTICE OF PROPOSED RULE MAKING

Adopted: April 9, 1992

Released: May 8, 1992

Comment Date: June 29, 1992

Reply Comment Date: July 14, 1992

Commenter: Daniel J. Marshall, President
Marshall Communications, Inc.

I. INTRODUCTION

Marshall Communications, Inc, is an Engineering firm specializing in conducting MMDS and ITFS interference studies and FCC applications related thereto. We have developed techniques and methods to quickly evaluate the potential for interference between MMDS stations and have adopted various graphical displays to illustrate the potential for interference or non-interference to one who would evaluate the study. (Details of some of these techniques are presented in Appendix B). As a result of hands on experience developing and using these tools we have developed a very good intuition for what is required to assess the potential for interference. Consequently, we feel qualified to comment in considerable detail about the aspects of the technical proposals contained in the Notice of Proposed Rule Making (NoPRM).

Since my background is primarily technical, I will limit my comments primarily to the technical aspects of the NoPRM which will include comments pertaining to the MSA/RSA issue. There is one additional issue concerning Frequency Coordination not addressed in the NoPRM (or anywhere else to my knowledge) that I believe should be brought before the Commission for consideration.

I strongly support the Commission's desire to curtail the activities of the "Application Mills" and I sympathize with the Commission's crushing burden of applications resulting therefrom with which it has to contend. The Commission has made certain proposals to moderate the "Application Mill" activity and has proposed certain technical modifications to ease the burden

of application processing. While certain of the technical modifications proposed may indeed alleviate the application processing bottleneck, I contend that certain of these modifications (such as the adoption of a fixed spacing criteria with short spacing exceptions in lieu of engineering interference studies) would further exacerbate the Application Mill problem by providing more "inventory" to sell, and would require many otherwise good station applications to be withdrawn. This proposal does not appear to be well thought out and I will comment on this in substantial detail.

My overall conclusion is that if certain of the proposed rule changes are adopted, that incalculable damage to the Wireless Cable industry will result. This would be a classic case of short-sightedness in adopting changes to expedite the Commission's immediate problems at the expense of crippling the entire industry in the long run. My main concern is that without detailed engineering analysis many licenses will be granted that simply will not work in real world situations. Were the terrain of this country indeed a flat surface, and the population uniformly distributed, the proposals may have some merit, however, terrain in most areas of the country was apparently not designed with MMDS in mind. In the following comments I will outline in detail why some of the proposed Rule changes would be detrimental to the MMDS industry and why some would be beneficial and suggest what I believe would be a far better alternative in simplification of application processing.

II. SEPARATION STANDARDS

GENERAL-In III. DISCUSSION, (12,) page 6 of NoPRM the Commission is proposing that the current 45 dB D/U signal interference standard and required detailed interference analysis be abandoned in favor of a fixed separation standard of 80 km for co-channel stations and 48 km for adjacent channel. It is referenced in the footnotes that this 80 km spacing criteria is derived by an assumed height-above-average-terrain (HAAT) of 180 meters. It is further suggested that the Applicant certify that there are no stations or proposed stations within the allowable distance and that dismissal of all applications and even perhaps there be criminal prosecution for falsification of this certification.

CERTIFICATION - Commenting on the last first, an applicant would be obliged to rely on the data confirming the existence of stations and proposed stations from data supplied by the Commission, and now the Commission wants to resort to dismissing all of an Applicant's applications or even to Criminal prosecution if one of his applications has incorrect information? Come on, give us a break. The Commission is not particularly noted for having accurate information in its files; even the MMDS inventory list comes replete with accuracy disclaimer. Some ITFS station engineers with whom I have had occasion to speak in relation to interference studies being conducted have strongly dissuaded me from using information from FCC files, rather have insisted on supplying their own station information, contending that FCC files were not current or correct regarding registered receive sites. This requirement would likely lead to endless disputes as to what was fraudulent representation and what is due to incomplete or unreliable information. I believe this proposal needs a lot of re-thinking and I disagree with it totally.

ADJACENT CHANNEL SEPARATION STANDARD - Establishment of a minimum fixed spacing requirement for adjacent-channel interference studies has considerable merit, I firmly support this proposal, however, it may not be valid for certain stations using highly directional antennas at certain orientations. NoPRM states that the rationale for selecting 48 km as the standard of determining whether harmful interference can exist is based upon the fact that this is twice the radius of the protected service area, therefore the length of the signal paths where the PSAs meet will be equal for both signals, thus resulting in zero dB D/U interfering signal ratio, thereby meeting the criteria for non-interference. Here the Commission is erring on the conservative side, having not taken into consideration the rejection ratio of the receive antenna. In actual practice adjacent channels of equal EIRP and the same polarization can be spaced much closer than 48 km (30 mi) and still exceed the required zero dB D/U signal requirement. Utilizing spreadsheet interference analysis studies, it can readily be demonstrated that for stations with equal EIRP, using omni-directional transmit antennas, the same polarization and including the directional characteristics of the FCC Reference receive antenna prescribed in the Rules, that better than a zero dB D/U ratio is always attained at station spacings of 29 km (18 mi) or greater, rather than 48 km as proposed. (If the transmit signals are cross polarized, adjacent channel interference is always 10 dB or greater for station spacings of greater than 15.27 miles, given the previous assumptions.) Appendix A shows an adjacent channel study conducted utilizing the spreadsheet study referenced above. Here it is demonstrated that at 18 miles spacing, that greater than zero dB (6.8) is achieved. The Rules should reflect actual conditions which include receive antenna characteristics rather than be based on a 2X protected service area that concludes that the required zero dB is achieved due to the equal path length of desired and undesired signals.

Since the current Rules call for transmit power to be specified in EIRP, and since an application can specify up to 200 watts EIRP without special consideration, I would suggest that an Applicant for a new station be granted the latitude of assuming an EIRP of 200 watts for previously authorized or proposed stations and that these stations or proposed stations be authorized to increase their EIRP to 200 watts without amendment.

With the assumption of equal EIRP (or greater than 200 watts for the studied station), a reasonable spacing criteria for stations utilizing omni-directional antennas would be 18 miles from an adjacent channel MMDS station; this encompasses either polarization. ITFS adjacent channels should be studied individually as they may have receive sites in close proximity to a station that is 18 miles away and/or may have less than 200 Watts EIRP. I do not see the adoption of this rule change as being detrimental to existing licensees or new applicants.

CO-CHANNEL SEPARATION STANDARD - The fixed 80 km spacing for co-channel stations is quite another matter. Using 180 meters HAAT to arrive at a radio horizon that dictates minimum station spacing is not an adequate criteria upon which to base station spacing; HAAT is only relevant in flat or relatively flat terrain. Since there is a vast difference in the 45 dB D/U Co-channel and 0 dB D/U adjacent-channel D/U requirement, a much more rigorous treatment of interference is required for co-channel stations. I have conducted a substantial number of studies utilizing shadow maps to determine direct electrical paths into another's

protected service area and I quite emphatically maintain that relying on HAAT for this determination is woefully inadequate. In terrain that is somewhat mountainous, HAAT has little or no relevance. In an effort to "simplify" the Rules for the Commission's expedience, the door is being opened wider for application mills to crowd additional stations into areas where they ought not be. Licensing or building a new station at a point that meets a spacing requirement and ignores signal coverage and interference studies can only harm existing operators and the TV public. Given the calibre of individuals that seem to have been attracted to Wireless Cable, this will likely spawn new opportunities for unscrupulous individuals to file applications for stations they know are un-workable, but can be used as instruments for blackmail of operators who are trying to run a legitimate business.

Also, not to be ignored, is that adopting a spacing criteria will likely increase the actual number of applications for the Commission to evaluate, quite likely offsetting gains derived from simplified applications. Quite simply put, engineering an MMDS station for interference free reception and maximum area coverage cannot be accomplished with a simple cookbook approach; it is far more complex than that, and unless the Commission realizes this and acts decisively and responsibly, the industry will likely find itself mired in a lot more confusion than presently exists. If licenses are granted that should not be granted and stations are built that should not be built, the stakes will be more onerous than application mill scams. The new genre of "builder-operator mills" springing up (or rather being converted to) will likely continue to extract mom and pop "investments" to ostensibly construct stations on some of the worthless licenses that likely will be issued if the separation standards are adopted. The Commission has a duty to protect the public from this type of activity, i.e. has a duty to not issue licenses that are worthless or even worse detrimental to the public TV audience. Adoption of this rule change would be detrimental to existing licensees and would do a dis-service to new applicants, especially those who will continue to fall prey to the "application mills". Also, the TV viewing public would be rendered a dis-service in that harmful interference will surely result in many cases.

SHORT SPACING DE-RATING TABLE - In view of my comments on the fixed separation proposal, my reaction to this matter will likely not come as much of a surprise. It obviously has about as much technical merit as the fixed separation proposal, i.e. none at all. Here again the Commission is flirting with disaster. There should be no short spacing whatsoever unless interference studies can unquestionably demonstrate that terrain will provide sufficient shielding to allow closely-spaced stations to operate without objectionable interference. Directional antennas in general do not have sufficient back side attenuation to assure non-interference when direct electrical paths exist into the PSAs of nearby co-channel stations utilizing the same signal polarization. The old adage "there ain't no such thing as a free lunch" applies to this proposal without reservation. Since MMDS stations have receive antennas at all orientations, there are areas in every station's PSA that must rely on terrain shielding, even if cross polarized. Relying on HAAT and separation criteria alone cannot guarantee no electrical paths into these areas. This is discussed further in Appendix B. In cases where cross polarization is not possible, most of the protected service area of the other station must be terrain shielded. It is as simple as that. All the little tricks in the book won't save you if there

exist a direct electrical path into the far side of the PSA of a co-polarized station in near proximity, or far away for that matter. A short-spacing table is an overall bad idea. The only reasonable alternative is to require demonstration of non-harmful interference which could be greatly facilitated by the adoption of some or all of the methods recommended elsewhere in these comments.

HAAT - Comments were requested concerning whether HAAT limitations should be placed on MDS to prevent the possibility of interference Firstly, limiting HAAT to 180 meters is not going to guarantee anything. Obviously in flat or near flat terrain limiting HAAT is quite straightforward and the results are meaningful, but in hilly or mountainous terrain HAAT has little relevance. On flat terrain, the 180 meters (591 ft.) seems to be a bit high. Shadow map studies using a K factor of 4/3 and a receive antenna height of 30 ft. indicates a radio horizon of just over 40 miles; perhaps a bit too much for many stations. Just limiting HAAT is an overly simplistic approach. There obviously needs to be some control over transmit antenna height, but limiting HAAT is not adequate. My recommendation to the Commission is to require a composite signal coverage map in the application, actually the inverse of a shadow map. This coverage map should be located on the same plot as those of the surrounding "studied" stations. I refer the reader to Appendix B for an example of this type of plot. It clearly shows the area of signal coverage and the potential for interference both to and from the surrounding stations. This visual display very quickly separates the wheat from the chaff; a quick glance will impart greater insight into the compatibility of closely spaced stations than hours of pouring over reams of difficult to interpret data. Its adoption as an application requirement would put an end to many worthless applications before they get off the drawing board. This is surely what the Commission wants, i.e. only applications that have sound technical merit. This step alone would go a long way toward putting a stop to applications being filed solely to satisfy the legal requirements of an application mill's sales contracts as well as making an application easier to evaluate. Of course some will argue that shadow maps may not tell you all you need to know about signal coverage. However, we are addressing interference here and can rely on the signal coverage map as an indicator of potential interference from direct paths into another's service area or from another station. The errors from vegetation and building losses will cause the errors to fall on the conservative side, instead of the opposite, such as occurs when attempting to determine the area of reliable signal transmission. The Applicant should be required to convincingly demonstrate that a newly proposed station can exist and provide reliable signal coverage to an adequate number of households such as to make constructing a station an economically viable endeavor and also to demonstrate that it will not cause harmful interference to other stations. Specifying HAAT and station separation simply cannot reliably predict any of the above except perhaps in a few areas where the terrain is substantially flat. Again my recommendation is to require composite signal coverage maps to illustrate whether direct electrical paths into other protected service areas exist. This is a far better tool to determine what transmit antenna height AGL is appropriate, rather than a fixed HAAT specification. Here the Applicant can engineer the site to cover the area of interest and assess whether his signal has direct electrical paths into other PSAs. Consequently this also makes the Commission's job of evaluating the application much easier. In addition, a shadow map covering a one hundred mile radius from the proposed station should also be included in

applications to examine far away stations for the presence or absence of direct electrical paths into other's receive sites or PSAs. Adoption of a fixed HAAT maximum may have some desirable effect, but the adoption of the superior method described above would have a very desirable effect on Wireless Cable as a whole as it presents a meaningful method of clearly identifying potential interference between stations. It would benefit licensees and applicants .

NOTIFICATION OF ITFS Operators within 70 miles - In (15), page 8 as footnoted in (29) of NoPRM it is suggested that MMDS operators build their station, notify ITFS operators within 70 miles 14 days in advance, then turn it on and see what happens. The Commission can't really be serious about this. Just what is being encouraged here? Taking all the proposed modifications into consideration and putting it into perspective, the Commission is effectively saying "go ahead, submit a half-baked application with no engineering, we'll give you a license if it meets some arbitrary criteria, spend your million bucks constructing a station, then turn that sum'bitch on and see what happens; if it doesn't work (interferes) turn it off and fix it, if you can, before you turn it on again". What if it can't be fixed? What does this poor sod do then? I don't think the American public deserves to be trifled with in this manner. To what has our modern day technological society degenerated? Is the relatively straightforward engineering task of conducting proper interference studies before submitting an application too much to ask of Applicants, or for the Commission to evaluate? If we can put a man on the moon, send spacecraft to the far ends of the solar system, splice genes, cure cancer and put communications satellites in orbit, how can it be that a relatively straightforward engineering procedure such as is required to demonstrate non-interference, be too overwhelming to even so much as evaluate. I see no objection to notifying the ITFS operator 70 miles away, but to suggest that an Applicant can submit an application and ostensibly get a license granted and even build the station without having a proper engineering study conducted to demonstrate non-interference is totally ludicrous. One thing the Commission should keep in mind is that some of the would be MMDS entrepreneurs aren't terribly bright when it comes to the technical aspects of building a station and they might just proceed to build some of these stations without doing the proper engineering. A far better solution would be to adopt a format for interference studies the Commission can readily evaluate, one that can't be easily tailored to conceal potential harmful interference.

I also take exception to the rule that says ITFS stations located beyond 50 miles of a proposed MMDS need not be studied. This rule is adequate for adjacent-channel stations, but is not adequate for co-channel stations, especially of the same polarization. The Rules should include requiring the study of any co-channel station, whether MMDS or ITFS, into which there exists a "direct electrical path", no matter how far away. Several thousand miles separation may be required to attain 45 dB D/U signal ratio if the receive antenna of another station's receive site with the same polarization is oriented directly toward the proposed station's transmit antenna and has a direct line of sight. A simple shadow study map is the most practical way of identifying where direct electrical paths exist. These areas can then be examined to see whether receive sites exist there, and if so the appropriate study should be done; this applies to ITFS and MMDS. One cannot rely on HAAT to predict anything; the proper studies must be done in all cases, it is as simple as that. It seems as though the Commission does not fully comprehend the potential for harmful interference, nor how to go about identifying it.

III. MSA/RSA BOUNDARIES

My comments regarding the adoption of RSA boundaries for MMDS applications is that it makes about as much sense as using the MSA boundaries for the same thing. In simple terms, it doesn't make any sense at all. There are only two factors that should have any bearing whatsoever on the placement and spacing of MMDS stations. These two factors are terrain and demographics. No where have I seen anything from the FCC that acknowledges either of these two factors as having much relevance, yet, ironically they are the only two factors of any relevance at all. For instance, consider the wisdom of granting a station license to Rochester, Minnesota and another to the adjoining RSA. Here is a small MSA, actually too small geographically for an MMDS station; the RSA is a seven county area completely surrounding the MSA. Now how do you propose for this area to operate as two separate and independent stations. The answer is that they could not possibly coexist unless they each had only half the available channels. Imposing this kind of nonsense on the American public is not the kind of thing that ought even be considered for a fleeting moment. Actually the seven county area together with Rochester would make quite a nice little station, just about the right size and with good terrain. Invoking some nonsense RSA criteria would only screw up what could otherwise be a good thing. (This is for example only, I have no personal interest in MMDS in this particular area). Some larger cities have so many ITFS stations, including grand-fathered E and F channels such that the MMDS licenses have never been granted and quite likely never will be. Yet the surrounding suburbs of some of the metropolises could easily support several MMDS stations; indeed many areas in these suburbs perhaps have no cable at all. These areas should be opened up such that stations can be built where they are needed. A hypothetical boundary line stretching some two hundred miles across a barren desert to the next state is total nonsense.

My recommendation is that absolutely no consideration whatsoever be given to RSA's as viable boundaries for MMDS stations. Furthermore, to effectively serve the Public interest, I strongly urge the Commission to totally abandon the MSA boundaries as having any relevance whatsoever to MMDS, as they obviously have none. Any other posture cannot be construed as serving the Public Interest. I urge the Commission to adopt the policy that MMDS station locations be dictated solely by terrain and demographics as it ought to have been from the outset, and to require rigorous demonstration of non-interference and that it be presented in a format the Commission can readily evaluate.

IV. RETENTION OF CURRENT STANDARDS

I would argue to retain the present standards. As stated before, application processing would be much easier with the adoption of the methods described herein. These methods present a much stronger application, one that is more difficult to contrive or fake, yet is more easily evaluated.

A far stronger argument for retaining interference standards is the avoidance of problems down the road that would result from removing the requirements for interference studies.

V. SETTLEMENT GROUPS

I see no objection to the proposals on eliminating settlement groups as a method of controlling "application mill activity". However, being clever people, I am sure they will find ways around it. I would add that, if possible, an application preparer or engineering firm not be allowed to submit more than one application for any one channel group in any given area.

VI. RETURN OF ALL PENDING APPLICATIONS

This is a rather Draconian approach, I am not sure I want to express an opinion on this, however, I would suggest that if this proposal is given serious attention that exclusive applications not be included, only those which have multiple applications.

VII. CONCLUSION

I strongly recommend that the Commission give up this foolhardy notion that MMDS applications can be reduced to a simplistic cookbook procedure for the expediency of application processing. I submit that qualified, experienced engineers who thoroughly understand the technical details and have struggled with the vicissitudes of very complex MMDS interference studies in various types of terrain and who have developed sophisticated, revealing methods to identify and quantify harmful interference have fully informed, well thought out opinions on this matter and their input should be very carefully considered before final decisions are made. I have struggled for extended periods with very difficult interference studies and I know for a fact that the 80 km spacing proposal is nonsense; there are instances where stations could be much closer and others instances where they should be much farther apart, however this determination cannot be read from a table. My recommendation to the Commission is to listen to those who have struggled with these matters and have a thorough understanding of the problems associated with interference, and rather than simplify the applications for the convenience of the Commission (and inadvertently for the application mills), I suggest that applications should be more rigorous rather than being reduced to a simplistic cook-book procedure, yet presented in such a manner as to expedite their evaluation and processing. An application should not be submitted unless it is thoroughly engineered such that it can be built and be fully expected to work as good as or better than engineering analysis predicts; no serious builder-operator would submit an application that has no technical merit. This requirement will lessen the number of applications by eliminating frivolous applications, and will deter subjecting the TV public to intolerable interference from stations that ought not have been licensed in the first place, but surely will be if the separation standards are adopted. Rather than embark down the surely disastrous road of cook-book applications to simplify the Commission's job, what is needed is an engineering format for applications that is both rigorous from an engineering standpoint, and also straight-forward for the Commission to evaluate. Again I refer the reader to Appendix B. If the Commission were to adopt certain of these techniques as requirements in application engineering studies, it would make applications technically much stronger and the evaluation

thereof of much easier.

V. FREQUENCY COORDINATION

Though comment was not requested in NoPROM, there is a matter I have been considering for some time that I would like to bring to the attention of the Commission for consideration. When attempting to coordinate an area that may perhaps be somewhat congested with MMDS and ITFS stations scattered about, it could become quite a chore to get all the license holders, their engineers and attorneys in agreement as to what polarization to use and where stations should be located (or relocated) etc. in order to best serve the community. There are likely communities where this will never be accomplished simply because there are too many Licensees with self-serving interests. It would seem that rather than a dozen or so license holders and their representatives trying to hammer out an agreement, that the Licensees/Selectees should be encouraged to engage the services of an independent third party (a qualified engineering firm) to frequency coordinate a complete area where stations are closely spaced. (Determining the boundaries of such areas might not be entirely straight-forward). This third party's responsibility would be to coordinate the area of congestion so as to best serve the public interest (and in so doing would best serve the interests of the individual licensees). (The individual parties would then be bound to this agreement, indeed would agree to be bound at the outset). The frequency coordination plan would then be filed with the Commission and all applications and modifications of licenses within that coordinated area would then be required to reference this frequency coordination plan and abide by the guidelines set forth therein. Also, once the frequency coordination plan had been adopted by all parties, it would be wise to submit all modifications for the area to the Commission at one time and have them processed such that all modifications became effective simultaneously so the individual Licensees could coordinate a date when the changeover would become effective (or perhaps this date should be specified by the Commission). This may seem like an administrative nightmare, but if properly implemented perhaps would solve a myriad of smaller problems and disagreements, and coordinate certain areas that may never otherwise achieve their maximum potential.

APPENDIX A

This study is presented to illustrate what station to station spacing is appropriate to guarantee non-interference between an existing station and a proposed station operating on an adjacent channel. The following is a tabulation of the study results of the individual components pertaining to the D/U ratio of interfering signals from a proposed station vs an existing station located 18 miles away. The study assumes equal EIRP, omni-directional transmit antennas and the directivity pattern of the FCC Reference Receive Antenna prescribed in 47 CF §21.902(f)(3)(Figure 1) oriented for optimal reception of the existing (D) station. It will be noted that the worst point of interference is on the "far side" of the existing stations protected service area and is 6.8 dB.

Rec. Site no.	Rec Site Coordinates						"D" EIRP (dBm)	"U" EIRP (dBm)	Dist. "U" Tx to Rx (mi)	"U" Free Space Path Loss (dB)	Dist. "D" Tx to Rx (mi)	"D" Free Space Path Loss (dB)	Excs "U" Path Loss (dB)	"D" Tx to Rx Azmth (deg)	"U" Tx to Rx Azmth (deg)	Angle of "U" Signl to Rx Ant (deg)	Rec. Ant. Disc. CoPol (d/u) (dB)	Tot. D/U Rat. (dB)	Harm-ful Inter-ference ?
R1	30	13	4N	100	0	0 W	53.0	53.0	3.00	114.4	15.0	128.4		0.0	180.0	180.0	25.0	11.0	No
R2	30	12	52N	99	57	24 W	53.0	53.0	4.14	117.2	15.0	128.4		10.0	141.3	131.3	22.6	11.4	No
R3	30	12	17N	99	54	52 W	53.0	53.0	6.44	121.1	15.0	128.4		20.0	127.3	107.4	19.1	11.7	No
R4	30	11	19N	99	52	30 W	53.0	53.0	9.00	124.0	15.0	128.4		30.0	123.8	93.9	18.0	13.6	No
R5	30	10	1N	99	50	21 W	53.0	53.0	11.62	126.2	15.0	128.4		40.0	124.1	84.1	18.0	15.8	No
R6	30	8	24N	99	48	30 W	53.0	53.0	14.19	127.9	15.0	128.4		50.0	126.1	76.1	20.0	19.5	No
R7	30	6	32N	99	47	0 W	53.0	53.0	16.69	129.3	15.0	128.4		60.0	129.0	69.0	20.0	20.9	No
R8	30	4	28N	99	45	54 W	53.0	53.0	19.07	130.5	15.0	128.4		70.0	132.5	62.5	20.0	22.1	No
R9	30	2	16N	99	45	13 W	53.0	53.0	21.33	131.5	15.0	128.4		80.0	136.2	56.2	20.0	23.1	No
R10	30	0	0N	99	44	59 W	53.0	53.0	23.43	132.3	15.0	128.4		90.0	140.2	50.2	20.0	23.9	No
R11	29	57	44N	99	45	13 W	53.0	53.0	25.35	133.0	15.0	128.4		100.0	144.4	44.4	20.0	24.6	No
R12	29	55	32N	99	45	54 W	53.0	53.0	27.08	133.5	15.0	128.4		110.0	148.7	38.7	20.0	25.1	No
R13	29	53	28N	99	47	0 W	53.0	53.0	28.62	134.0	15.0	128.4		120.0	153.0	33.0	18.3	24.0	No
R14	29	51	36N	99	48	30 W	53.0	53.0	29.94	134.4	15.0	128.4		130.0	157.4	27.5	16.5	22.5	No
R15	29	49	59N	99	50	21 W	53.0	53.0	31.04	134.7	15.0	128.4		140.0	161.9	21.9	16.0	22.3	No
R16	29	48	41N	99	52	30 W	53.0	53.0	31.89	135.0	15.0	128.4		150.0	166.4	16.4	16.0	22.5	No
R17	29	47	43N	99	54	52 W	53.0	53.0	32.51	135.1	15.0	128.4		160.0	170.9	10.9	7.9	14.6	No
R18	29	47	8N	99	57	24 W	53.0	53.0	32.88	135.2	15.0	128.4		170.0	175.5	5.5	0.5	7.4	No
R19	29	46	56N	100	0	0 W	53.0	53.0	33.00	135.3	15.0	128.4		180.0	180.0	0.0	0.0	6.8	No
R20	29	47	8N	100	2	36 W	53.0	53.0	32.88	135.2	15.0	128.4		190.0	184.5	5.5	0.5	7.4	No
R21	29	47	43N	100	5	8 W	53.0	53.0	32.51	135.1	15.0	128.4		200.0	189.1	10.9	7.9	14.6	No
R22	29	48	41N	100	7	30 W	53.0	53.0	31.89	135.0	15.0	128.4		210.0	193.6	16.4	16.0	22.5	No
R23	29	49	59N	100	9	39 W	53.0	53.0	31.04	134.7	15.0	128.4		220.0	198.1	21.9	16.0	22.3	No
R24	29	51	36N	100	11	30 W	53.0	53.0	29.94	134.4	15.0	128.4		230.0	202.6	27.5	16.5	22.5	No
R25	29	53	28N	100	13	0 W	53.0	53.0	28.62	134.0	15.0	128.4		240.0	207.0	33.0	18.3	24.0	No
R26	29	55	32N	100	14	6 W	53.0	53.0	27.08	133.5	15.0	128.4		250.0	211.3	38.7	20.0	25.1	No
R27	29	57	44N	100	14	47 W	53.0	53.0	25.35	133.0	15.0	128.4		260.0	215.6	44.4	20.0	24.6	No
R28	30	0	0N	100	15	1 W	53.0	53.0	23.43	132.3	15.0	128.4		270.0	219.8	50.2	20.0	23.9	No
R29	30	2	16N	100	14	47 W	53.0	53.0	21.33	131.5	15.0	128.4		280.0	223.8	56.2	20.0	23.1	No
R30	30	4	28N	100	14	6 W	53.0	53.0	19.07	130.5	15.0	128.4		290.0	227.5	62.5	20.0	22.1	No
R31	30	6	32N	100	13	0 W	53.0	53.0	16.69	129.3	15.0	128.4		300.0	231.0	69.0	20.0	20.9	No
R32	30	8	24N	100	11	30 W	53.0	53.0	14.19	127.9	15.0	128.4		310.0	233.9	76.1	20.0	19.5	No
R33	30	10	1N	100	9	39 W	53.0	53.0	11.62	126.2	15.0	128.4		320.0	235.9	84.1	18.0	15.8	No
R34	30	11	19N	100	7	30 W	53.0	53.0	9.00	124.0	15.0	128.4		330.0	236.2	93.9	18.0	13.6	No
R35	30	12	17N	100	5	8 W	53.0	53.0	6.44	121.1	15.0	128.4		340.0	232.7	107.4	19.1	11.7	No
R36	30	12	52N	100	2	36 W	53.0	53.0	4.14	117.2	15.0	128.4		350.0	218.7	131.3	22.6	11.4	No

APPENDIX B

Methods for illustrating interference studies to aid in ease of evaluation

One study method Marshall Communications, Inc. has developed illustrates quite clearly at a glance whether the potential for interference does or does not exist. These studies are relatively easy to conduct, quite easy to evaluate and are very revealing. This method is referred to as a "composite signal coverage map"; it is comprised of the signal coverage of the proposed station and all surrounding stations on a single plot. At a mere glance, the composite signal coverage map not only shows the areas served by all stations, but also quite clearly exposes the presence or absence of direct electrical paths, hence the potential for, or the probable absence of interference from a proposed station. Fig. 1 illustrates this method; it is presented to the Commission as an example to illustrate that a rigorously engineered interference study need not be overly burdensome to evaluate, and that the most powerful techniques can be the easiest to evaluate. I suggest that this type map be required as a part of exhibit E in applications requiring demonstration of non-interference.

Reference was made in the comments to the use of spreadsheet analysis in conducting studies. I do not wish to belabor the point, but to my way of thinking, when studies are presented in spreadsheet format they are easier to evaluate, as all information is available at a glance. Also, this reduces the sheer volume of some complex ITFS applications with large numbers of receive sites. Another definite advantage is the reduction of mistakes due to data entry and computational errors, etc.; once you accept the model as being accurate to represent a bona fide study, little remains but to peruse the numbers, for spreadsheets don't make mistakes once properly configured. Also, all studies (MMDS and ITFS, both co-channel and adjacent-channel) can be presented on this identical format thereby simplifying evaluation.

The spreadsheet study model can be used as a tool to derive families of curves showing potential areas of interference from another station. For instance, it can be determined that, at a station spacing of approximately 46 miles the only area where potential for interference exists for cross-polarized stations using omni-directional antennas, equal EIRP, FCC reference receive antenna and a 45 dB required D/U ratio is in a rounded off pie shape on the far side of the studied station encompassing approximately +/- 19 degrees at the perimeter of its PSA. At greater spacings this area shrinks; at lesser spacings "ears" appear on either side of this wedge at the perimeter. A family of curves that outline exactly where the potential for interference vs station spacing can readily be derived. Only areas within these defined curves need be examined for interference, all other areas meet interference requirements. A shadow map encompassing the protected service area will determine whether direct electrical paths exist into these areas of potential interference. If they do, then harmful interference will occur, study is completed. If they do not, then Radio Path interference studies can be conducted at the appropriate points to quantify the amount of predicted terrain attenuation. This amount, summed with the other components, then indicates the predicted D/U ratio of interfering signal; if it can be demonstrated that the worst case point has 45 dB or greater attenuation, the absence of harmful interference has been demonstrated. A similar set of curves can be derived for co-polarized stations. Here the only area unconditionally free from interference is near the D transmitter. All other areas must rely on terrain shielding. It is this kind of

* Distances are calculated using the FCC method described in 47 CFR 73.208(c). FSPL according to the formula $FSPL = 32.45 + 20 \log \text{Freq(mHz)} + 20 \log \text{Dist.(km)}$. Since spreadsheets calculate to approximately 15 decimal places, one can assume some reasonable degree of accuracy.

cook-book engineering (supplemented by shadow maps, composite signal coverage maps and Radio Path studies) that should be applied rather than some arbitrary, relatively meaningless separation standard, HAAT and separation derating table. Presuming that HAAT and station separation can yield equivalent (or even acceptable) results is extremely naive.

A recent study was conducted against an ITFS station with 180 receive sites; this station had a CP granted at a new transmit site. Therefore, it was necessary to study all receive sites twice. After entering the coordinates, the actual study took about three seconds to calculate and another three seconds to do the study from the newly proposed transmit site. This study was then presented in spreadsheet format requiring about three or four pages rather than approximately 60 or perhaps as many as 180 pages for each of the two studies when presented in the customary format.

Rather than exact dismissal of all applications and threaten possible legal action against applicants who mis-state whether there is a previously proposed station closer than 80 km, it would be far better to require a rigorous demonstration of non-interference and exact these same severe penalties for fraudulent engineering exhibits. When terrain blockage is claimed, it should be supported in the form of radio path studies. Applications should have a shadow map of 100 miles radius to identify whether there are other stations into which there exists a "direct electrical path".

As can be seen, if the Commission would adopt some or all of the techniques described herein (or perhaps similar techniques from others more gifted than I), as a standard for an MMDS interference study format, the Commission would start getting honest applications that are quite easy to evaluate. The cost of software to run Shadow Maps, Field strength maps, Received Power level maps, Radio Path studies and the associated terrain data files are available off the shelf for less than two thousand dollars and run on standard IBM and IBM compatible computers and laser printers, therefore, it would not be unduly burdensome to require this amount of investment from engineering firms conducting interference studies.

I suggest that the Commission carefully evaluate some of the illustrative methods shown here and consider their adoption (or the adoption similar techniques others may propose) as a means to ease the burden of application processing, rather than removing the engineering requirements thereby creating an environment conducive to abuse.

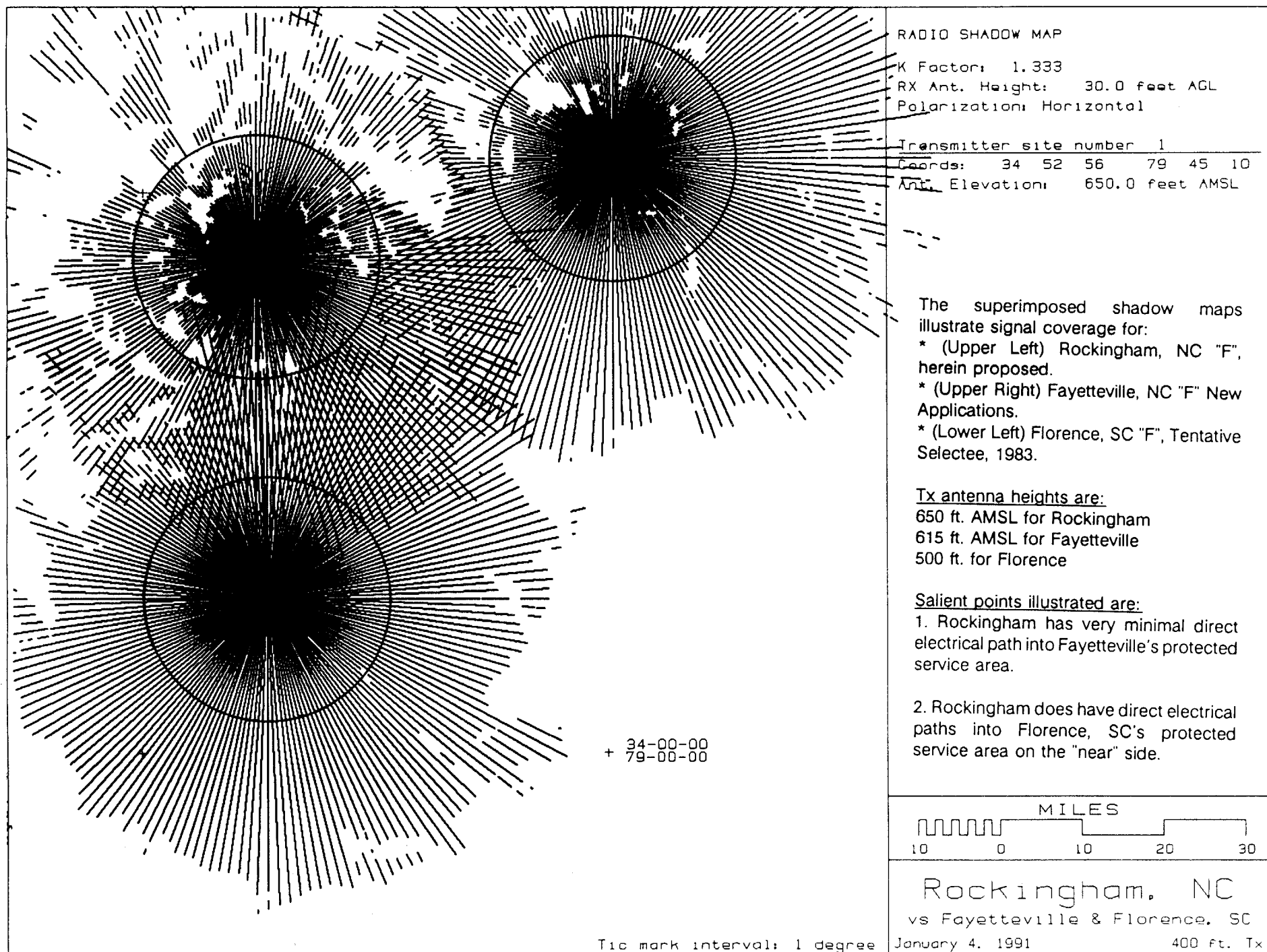


Figure 1 - Composite Signal Coverage Map